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Diploma Examinations Program Bulletin

Biology 30, Chemistry 30, Physics 30

1991-92 School Year

Students First!
Student Evaluation

Alberta
EDUCATION

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SCIENCES BULLETIN

SCIENCES DIPLOMA EXAMINATION UPDATE FOR 1992

The following information has been updated for teachers and students of Biology 30, Chemistry 30, and Physics 30:

- **Grade 12 Diploma Examinations Schedule, 1992,**
- **Marking Information, 1992,**
- **Field Testing and Item Writing, 1991-92,**
- **General Information, and**
- **Subject-Specific Information.**

Grade 12 Sciences Diploma Examinations Schedule, 1992

The 1992 Sciences diploma examinations will be administered as follows:

DATE	SUBJECT	TIME
January 29, 1992	Chemistry 30	1:00 - 3:30 p.m.
January 30, 1992	Physics 30	9:00 - 11:30 a.m.
	Biology 30	1:00 - 3:30 p.m.
June 25, 1992	Chemistry 30	9:00 - 11:30 a.m.
	Physics 30	1:00 - 3:30 p.m.
June 26, 1992	Biology 30	9:00 - 11:30 a.m.
August 19, 1992	Chemistry 30	9:00 - 11:30 a.m.
	Biology 30	1:00 - 3:30 p.m.
August 20, 1992	Physics 30	9:00 - 11:30 a.m.

Marking Information, 1992

The written-response portion of the sciences diploma examinations is marked by classroom teachers.

To qualify as markers, teachers must:

- be recommended by their superintendents;
- have taught the subject for two or more years;
- be currently teaching the subject; and
- have an Alberta Permanent Professional Certificate.

We particularly need teachers who can mark examinations written in French.

Teachers who wish to be recommended as markers for the January 1992 examination should contact their superintendents before September 30, 1991.

Teachers who wish to be recommended as markers for the June and August 1992 examinations should contact their superintendents before March 2, 1992.

Marking Dates

Examination	January 1992 Administration	June 1992 Administration	August 1992 Administration
Biology 30	February 5-8	July 7-11	August 21-22
Chemistry 30	February 5-8	July 7-11	August 21-22
Physics 30	February 5-8	July 7-11	August 21-22

Field Testing and Item Writing, 1991-92

As the need arises for teachers to participate in field testing and item writing, letters are sent to superintendents requesting their nominations of teachers interested in these activities. Teachers who are interested should let their superintendents know early in the school term.

GENERAL INFORMATION

Format

The time allotted to write the diploma examinations in the sciences is two and one-half hours. All three examinations consist of machine-scorable questions and written-response questions.

The machine-scorable questions are multiple-choice and, for Chemistry 30 and Physics 30, numerical-response questions as well. Please refer to the chemistry and physics sections of this bulletin for further details regarding numerical-response questions.

A separate data booklet is provided for the Chemistry 30 and the Physics 30 examinations.

NOTE: The sciences diploma examinations may contain questions that require students to synthesize concepts from more than one unit of study.

The Use of Calculators on Examinations

The term *calculator* includes all hand-held devices designed primarily for mathematical computations. Such devices are scientific calculators, graphing calculators, calculators that are capable of programming functions, and calculators with built-in functions. We have not included computers or devices with a primary function of random access storage in our use of the term *calculator*.

Examinations will be constructed to ensure that the use of particular calculators causes neither advantages nor disadvantages to individual students.

Please refer to Appendix A for the policy statement on the use of calculators on diploma examinations.

Students should be made aware of this policy as early as possible in the school term to ensure they are allowed to use the calculator of their choice on their examinations.

Students should also be made aware of the Examination Rules, Grade 12 Diploma Examinations, one of which states that notes stored in electronic devices may not be brought into the examination room. See Appendix B for a copy of the Examination Rules.

Performance Standards

Standards in education are statements that communicate the level of performance necessary to attain a specific goal or objective. Statements of standards assist educators in determining the extent to which students must know the content and demonstrate the required skills to pass the course.

Performance standards for each subject are discussed on pages 5, 16, and 32. These standards of performance are applicable to students who attain the *acceptable* standard (a final mark of 50% or higher) and those students who attain the standard of *excellence* (a final mark of 80% or higher).

We would appreciate your feedback on these statements of performance standards. Please address your concerns or suggestions for improvement to:

Assistant Director
Mathematics/Sciences
Student Evaluation Branch
Alberta Education
Box 43, 11160 Jasper Avenue
EDMONTON, Alberta
T5K 0L2 FAX: 422-4200

Examiners' Reports

Following the administration of the examinations, examiners' reports are released. These reports briefly outline the statistical data obtained from the examination administration and provide a diagnostic overview of student performance on each examination. Examiners' reports are designed for teacher use. If we can make these reports more useful to you, please let us know. You can reach our examination managers for the sciences at 427-2948, or by writing to us at the above address.

Annual Report

An annual report that summarizes results from the January, June, and August diploma examination administrations is released in the fall of each year. The purpose of this report is to inform educators and the public about student achievement in relation to provincial standards.

SUBJECT-SPECIFIC INFORMATION

BIOLOGY 30

Performance Standards

Students of Biology 30 have developed their aptitude for observing, collecting facts, forming generalizations, hypothesizing, and making inferences from observations. They have shown growth in their understanding of biological concepts by their increased ability to apply these concepts to relevant situations and to communicate in the specialized language of biology.

This growth and development in students has taken place as a result of general education and cognitive maturation. It has been enhanced by science courses, and in particular by the successful completion of Biology 10 and 20.

Students who attain an *acceptable* standard of performance in Biology 30 receive a final mark of 50% or higher. They can demonstrate a basic understanding of the nature of scientific investigation by designing and interpreting simple laboratory tests. They can readily interpret data that are presented in simple graphs and tables, and can translate symbolic representations of biological functions into word descriptions. They can recognize readily and provide definitions for key biological terms. These students can demonstrate an acceptable level of understanding of biological concepts by tracing the pathways that materials follow as they are transported through human organ systems, by sequentially ordering the major steps of a physiological process, and by formulating simple structural and functional comparisons among components of human organ systems. They can relate human physiological concepts to common everyday experiences, but they may have difficulty relating these concepts to health problems. These students can compose clear and logical descriptive or explanatory statements about major human physiological concepts.

Students who attain a standard of *excellence* in Biology 30 receive a final mark of 80% or higher. In addition to meeting the expectations for an acceptable standard of performance, these students demonstrate their ability and interest in biology and feel confident about their abilities. They can readily interpret interrelated sets of data such as complex graphs and tables. When presenting scientific data, they select the most appropriate form. These students can analyze and evaluate experimental designs. They can easily identify significant parts of human organs and can describe their functions clearly and accurately. They can analyze human physiological problems that involve several interrelated steps, and they can form inferences from extracurricular data that are provided with the problem. These problems would most likely involve regulatory feedback loops and/or a minimum of two interacting human organ systems. Exceptional students can communicate clearly and concisely, using appropriate scientific vocabulary. Multiparagraph compositions are within their grasp.

Structure of the Examination

Each Biology 30 diploma examination is designed to reflect the core concepts outlined in the *Program of Studies for Senior High Schools*. The examination is limited to those objectives that can be measured by a paper and pencil test.

Content

The content of the 1992 Biology 30 diploma examinations has the following approximate emphasis on core concepts:

Concept[1]	Per Cent Emphasis
Cellular Processes	9
Homeostatic Mechanisms	4
Nutrition and Digestion	16
Body Fluids	15
Breathing, Gas Exchange, and Transport	7
Energy Release	5
The Kidney	10
Regulation of the Internal Environment	20
Voluntary Movement and Body Support	4
Human Reproduction	10

Design

The design of the 1992 Biology 30 diploma examinations is as follows:

Question Format	Number of Questions	Per Cent Emphasis
Multiple Choice	70	70
Written Response	5	30

Examination Specifications

The three cognitive levels[2] of Knowledge, Comprehension and Application, and Higher Mental Activities are addressed throughout the examination. The emphasis on each cognitive level for each section of the examination is as follows:

	Per Cent Emphasis
Multiple Choice	
Knowledge	25
Comprehension and Application	35
Higher Mental Activities	10
Written Response	
Comprehension and Application, Higher Mental Activities	30

---

[1] Concept descriptions have been shortened in this table.

[2] An explanation of cognitive levels is given in Appendix C.

Process skills are addressed throughout the examination, and in particular by one 10-mark question in the written-response section.

Each examination is built as closely as possible to the above specifications. Small adjustments in emphasis may be necessary because the examination includes multimark written-response questions and/or machine-scored questions that cover more than one concept area. The concept areas are distributed proportionately over the cognitive levels and vice versa. Questions that require knowledge and skill in applying scientific processes are distributed throughout the examination but are not associated with specific topics or cognitive levels.

Emphases in the 1992 Biology 30 Diploma Examinations

- Some questions will include contextual material that goes beyond the common scope of the core concepts as defined in the curriculum guide. The inclusion of these question types is not only appropriate but also necessary if the measurement of higher cognitive skills (application, analysis, evaluation) is to be achieved.

- Committees of teachers are encouraged to develop questions that address the broadest possible range of course objectives measurable by a "paper and pencil" instrument. This will include emphasizing the understanding of human physiology rather than the rote memorization of human anatomy, integrating the main core concepts rather than treating each in isolation, relating the human organism to other life forms rather than just treating it in isolation, and incorporating technological concepts, the nature of science, and historical perspectives if appropriate.

- The 30 marks allotted to the written-response section of the 1992 Biology 30 examinations will be distributed among five questions. One of the five questions will present a synopsis of a research project including pertinent data in the form of graphs and/or tables. Several subquestions that require the students to demonstrate a variety of process skills will be presented. This composite question will have a total mark value of 10. (Refer to pages 11 to 15 for a sample question with sample answers.)

  Another written-response question will be worth six marks: four marks for concepts and two marks for written communication skills. The mark value out of four for concepts will be determined by using an analytical scoring guide, whereas the mark value out of two for communication will be determined by using a criterion-referenced scale.

  The remaining three questions in the written-response section will range in value from four to six marks. These questions will be clearly defined contextual problems that have specific solutions based on the core concepts of the course. Student responses for each of these questions will be measured by using an analytical scoring guide.

Changes to the 1993 and 1994 Biology 30 Diploma Examinations

The per cent emphasis of multiple-choice and written-response questions will continue to be 70% and 30% respectively. However, the written-response section will consist of four questions as follows:

- One data-based/process skill question with a value of 10 marks, as introduced on the 1992 Biology 30 examinations.
- One open-ended integrative question with a value of 10 marks. This question will present a clearly defined problem that provides for a number of different solutions. The problem will be centred on biological concepts but will also include one or more other components (technology, societal implications, nature of science). This question will also provide an opportunity to measure students' written communication skills. Criterion-referenced scales will be used to measure the various components of the students' responses.
- Two prescriptive questions with a value of 4 to 6 marks each for a total of 10. These questions will present clearly defined contextual problems that have specific solutions based on the core concepts of the course. Analytical scoring guides will be used to measure the students' responses.

Clarification of Word Usage for Biology 30 Diploma Examinations

1. Cytoplasm

Problems:

a. Some authors (Berry, Kormondy) use the term cytoplasm to identify a substance in the cell, but others (Guyton, Vander) use the term to identify a region of the cell.

b. Both uses of the term cytoplasm include the organelles as a part of the cytoplasm. Most authors use the term "cytosol" to designate the clear fluid portion of the cytoplasm in which the large particles and organelles are dispersed.

Clarification:

cytoplasm - "the protoplasm of a cell external to the nuclear membrane"

nucleoplasm - "the protoplasm of a nucleus"

protoplasm - "the organized colloidal complex of organic and inorganic substances (as proteins and water) that constitutes the living nucleus, cytoplasm, plastids, and mitochondria of the cell and is regarded as the only form of matter in which the vital phenomena are manifested."

Webster's Ninth New Collegiate Dictionary.

2. ECF (extracellular fluid)

Problem:

Confusion may arise if specific body fluids are identified with the general label ECF.

Clarification:

A body fluid is either intracellular or extracellular. Extracellular fluids are found in distinct regions of the body and therefore may be identified with specialized names. Interstitial fluid is the immediate environment of body cells. Blood plasma is the ECF found within the closed circulatory system. Glomerular filtrate is the special ECF found within Bowman's capsules. When making comparisons between two fluids that both lie outside cells, care must be taken that ECF is not used to label either of them because extracellular fluid is an inclusive term.

3. Golgi Apparatus or Complex

Problem:

The term "Golgi body" is frequently confused with "Golgi apparatus." A Golgi body is "a discrete particle of the Golgi apparatus as observed in a stained preparation - called also dictyosome." (*Webster's*)

Clarification:

A Golgi apparatus or complex is a cytoplasmic organelle that consists of a flattened collection of membrane-enclosed sacs (cisternae). The Golgi apparatus is usually located close to the nucleus. At least one Golgi apparatus is found in almost all eukaryotic cells except erythrocytes. Secretory cells may possess many Golgi apparatuses. It should be noted that the terms Golgi apparatus and Golgi body are not synonymous and therefore should be used with care as cell diagram labels.

4. Secretion

Problem:

The term is frequently used to describe the transfer of any substance from a tissue or organ without taking into account whether or not the substance is formed by the structure.

Clarification:

The term should be used for the release of a material from a structure that also forms it. *Webster's Ninth New Collegiate Dictionary* defines secretion as "the process of segregating, elaborating, and releasing some material either functionally specialized (as saliva) or isolated for excretion (as urine)." This definition indicates that formation as well as delivery of a substance is involved in the process.

5. Osmotic Pressure

Problem:

Confusion may arise because the term "osmotic pressure" has several acceptable definitions. A number of authors use it to describe the osmotic potential of a solution.

Clarification:

Several definitions will illustrate the most common uses of the term.

Neil A. Campbell. "A measure of the tendency of a solution to take up water when separated from pure water by a selectively permeable membrane."

Arthur C. Guyton. The amount of pressure required to stop osmosis completely when pure water is separated by a semipermeable membrane from a solution containing a nondiffusable solute (paraphrase).

Helena Curtis. "Osmotic potential is the tendency of water to move across a selectively permeable membrane into a solution; it is determined by measuring the pressure required to stop the osmotic movement of water into the solution; the higher the solute concentration, the greater the osmotic potential of the solution."

6. Transmission of the Nerve Impulse

Problem:

The explanation presented by Berry on pages 138 to 140 is not consistent with the explanations provided by other authors (Campbell, Guyton, Curtis).

Clarification:

It is recommended that other texts be consulted for clarification of resting potential, action potential, and refractory period. Particular attention should be given to the sodium and potassium ionic gradients, facilitated diffusion of sodium and potassium ions through voltage-sensitive channels, and the function of the sodium-potassium pump. It should be noted that the resting potential of -70 mv is primarily caused by the leakage of K^+ out of the neuron and the relatively high concentration of intracellular negatively charged organic ions (not Cl^-).

The action potential is created by the inward rush of Na^+, and repolarization of the membrane is brought about by the outward rush of K^+. Restoration of the resting potential ion distribution is brought about by the sodium-potassium pump coupled with the regulation of voltage-sensitive channels.

7. Nomenclature

- The spelling of adrenalin(e) and thyroxin(e) should include the letter e because the words then clearly indicate natural products of the endocrine glands rather than commercial forms of the hormones.

- Most authors use LH and not ISCH for the pituitary hormone in males that stimulates the testes to produce testosterone. Both FSH and LH have exactly the same molecular structure in males and females; therefore, the same names should be used for both sexes.

Sample Question: Data-based/Process Skill Question

Use the following information to answer question 1.

A Summary of Research on SAD - Seasonal Affective Disorder (Reference: Wurtman, R.J. and Wurtman, J.J. "Carbohydrates and Depression," *Scientific American*, January 1989)

Background Information

Disorder	Cyclic Pattern	Biochemical System	Symptoms
SAD - seasonal affective disorder (winter depression)	yearly - fall and winter	pineal gland of the brain produces melatonin - affects mood and energy levels	- depression - lethargy - inability to concentrate - bouts of overeating - excessive weight gain

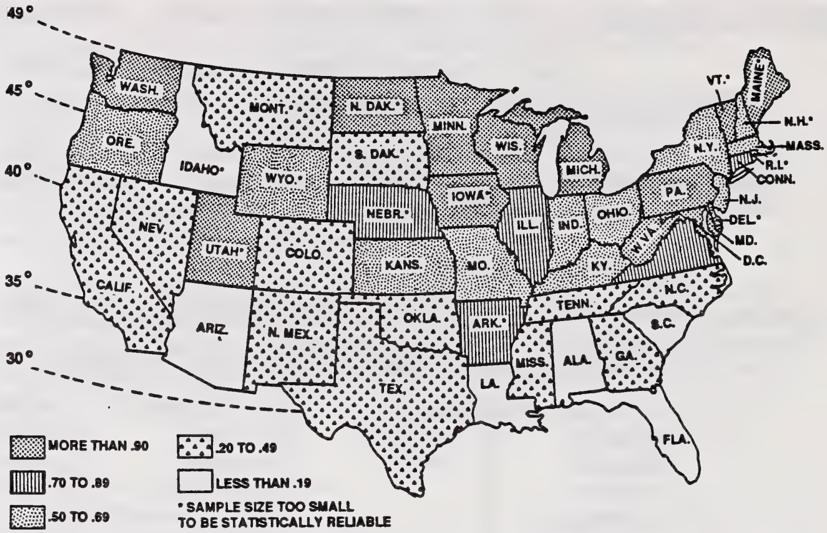
Problem

Is the disorder SAD caused by seasonal fluctuations in the length of day and night (photoperiodism)?

Procedure

In March of 1985, researchers attempting to correlate SAD with latitude wrote a description of SAD in the national newspaper, USA Today, without any reference to the presumed connection between SAD and day length. A questionnaire was included asking readers to answer "Yes" or "No" to 15 statements which described symptoms of this disorder. Anyone answering "Yes" to eight or more questions (characterized as having seasonal affective disorder) was invited to send in his/her questionnaire to the newspaper. A total of 723 responses were received. The frequency of SAD sufferers per state was calculated by dividing the number of respondents with the average daily sales of USA Today in that state. Results appear on the following frequency map.

Continued



Prevalence of SAD in the United States

Results from the survey indicate that 100 people per 100 000 in the northern states and 6 people per 100 000 in the southern states suffer from SAD. The authors noted that these results may be low since people suffering from the disorder would NOT readily respond to newspaper surveys because they would be depressed and have low energy levels.

Further research indicates that melatonin secretion rises at night and decreases during the day in both laboratory rats and humans. Evidence indicates that melatonin levels in humans can be suppressed if light of sufficient intensity and duration is available (2,500 lux [lux is a unit of light intensity - a household lamp gives off about 250-500 lux of light] for about 2 hours). M. Terman of Columbia University reported that exposure to light of this intensity and duration early in the morning reduced almost totally both depression and carbohydrate craving in about 50% of SAD sufferers. Most of the other 50% showed signs of some improvement.

(2 marks) 1. a. From the information given in this summary, identify TWO factors that affect the production of melatonin in the pineal gland.

i. ____

____

ii. ____

____

(2 marks) b. The authors of the article conclude that the frequency of SAD sufferers is higher in the northern states of the U.S.A. than in the sourthern ones. From data presented on the frequency map, construct an argument to EITHER support or refute this conclusion.

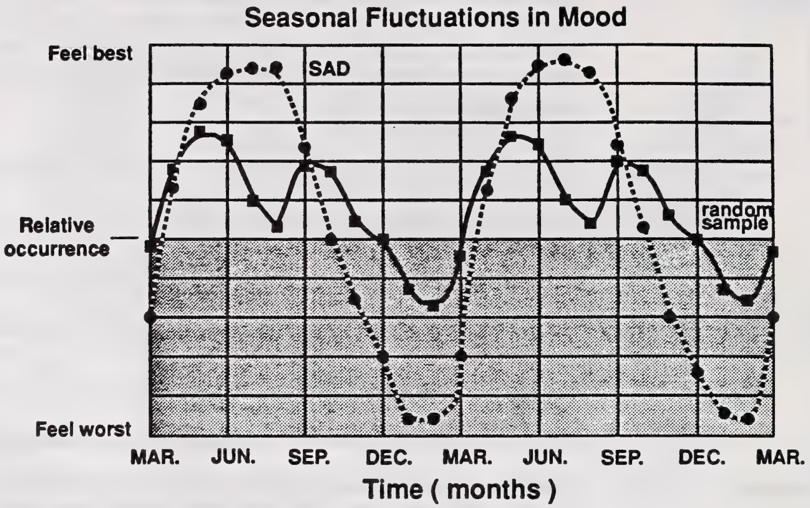
(4 marks) c. Examine carefully the summary of the research that attempts to correlate the frequency of SAD occurrence and latitude. Identify the manipulative and responding variables. Describe ONE variable that should have been controlled in order to make the results of the newspaper survey scientifically stronger. Explain how controlling this additional variable would make the results more reliable.

i. Manipulated variable ______________________

ii. Responding variable ______________________

iii. Additional variable ______________________

Explanation ______________________



SEASONAL FLUCTUATIONS in mood are common among people in New York City (and in other northern areas) but are severest in patients diagnosed with SAD. The data are from a study by Michael Terman of the New York State Psychiatric Institute.

(2 marks) d. Based on the graph of New York City residents, what conclusions can be drawn about the seasonal fluctuations in mood?

Sample Answers to the Data-based/Process Skill Question

(2 marks) 1. a. i. 1 mark - The intensity of light exposure

ii. 1 mark - The duration of light exposure

(2 marks) b. Support:

1 mark - In northern states such as Minnesota, Wisconsin, and Michigan, SAD affects more than 100 people per 1000, whereas in Florida, Alabama, and Louisiana, SAD affects fewer than six people per 1000.

1 mark - States that present contradictory evidence, such as Idaho and Arkansas, have sample sizes too small to be statistically reliable.

OR

Refute:

1 mark - The distribution of people affected by SAD is inconsistent. Some states that are at high latitudes, such as New York and Massachusetts, show frequencies lower than states that are located farther south, e.g., Virginia.

1 mark - A large proportion of northern states provided sample sizes too small to be statistically reliable; therefore, valid conclusions about the relationship of SAD and latitude cannot be formed.

(4 marks) c. i. Manipulated variable

1 mark - The latitude where a person lives

OR

The length of day in March where a person lives

ii. Responding Variable

1 mark - The reported feeling of depression/carbohydrate craving

OR

Eight or more questions answered "yes" in the survey

iii. Additional Variable

1 mark - Any ONE of the following variables:

- sex of respondents
- age of respondents
- general health of respondents
- data about weather conditions in March
- using general population instead of readers of *USA Today*
- random sampling of an equal size population in each region.

Explanation

1 mark - A good defence of the variable presented

(2 marks) d. 1 mark - All the people in the study reported feeling better in the summer than in the winter.

1 mark - The people affected by SAD experienced mood swings more pronounced than the random sample.

CHEMISTRY 30

Performance Standards

Students who attain a minimum *acceptable* standard of performance but do not attain the standard of excellence in Chemistry 30 have gained new knowledge and abilities in chemistry but can anticipate difficulties if they choose to enrol in postsecondary chemistry courses. Such students can state and solve numerous problems that require only a one-step solution. For example, they can derive a pH value from a given hydronium ion concentration or find the net voltage for a redox reaction by using the data booklet. These same students would experience difficulty with multiple-step problems such as finding the pH of a partially neutralized mixture of an acid and a base. They are also unlikely to correctly answer questions involving concepts from more than one unit. They are capable of balancing an equation (combustion, formation, neutralization, or redox) and of solving the standard stoichiometric problems based upon these equations. Following the directions in laboratory procedures does not present a problem for these students, nor does drawing a graph from experimental data or reading values from the graph.

Students who attain a standard of *excellence* in Chemistry 30 should be well enough prepared to undertake successfully the next level of chemistry, whether it be at a university, a technical school, or a nursing school. These students can create their own laboratory procedures when given a clear definition of a problem. They can recognize weaknesses in laboratory work and can find ways of correcting the weaknesses. These students can write their own equations for formation, combustion, neutralization, and redox reactions, and can solve many variations of stoichiometric problems based upon these equations. They are able to transfer what they see happening in a test tube into equation form and are able to express scientific ideas clearly. They can extract valid inferences from graphical data. They can usually cope with problems that involve overlap of two or more concepts. The most significant characteristic of this group is that they can solve problems of a new and novel nature and can extrapolate these solutions to higher levels of understanding. These students usually possess good communication skills and can extract vital information from laboratory data or from word problems.

Structure of the Examination

Each Chemistry 30 diploma examination is designed to reflect the core content outlined in the *Program of Studies for Senior High Schools.* The examination is limited to those objectives that can be measured by a paper and pencil test.

Content

The content of the 1992 Chemistry 30 diploma examination has the following approximate emphasis on core concepts.

Concept[1]	Per Cent Emphasis
Chemical Energetics	32
Acids and Bases	34
Oxidation-Reduction	34

Design

The design of the 1992 Chemistry 30 diploma examinations is as follows:

Question Format	Number of Questions	Per Cent Emphasis
Multiple Choice	42	60
Numerical Response	7	10
Written Response	3	30*

Examination Specifications

The three cognitive levels[2] of Knowledge, Comprehension and Application, and Higher Mental Activities are addressed throughout the examination. Each cognitive level has the following emphasis:

Multiple Choice and Numerical Response	Per Cent Emphasis
Knowledge	30
Comprehension and Application	35
Higher Mental Activities	15
Written Response	
Comprehension and Application, and Higher Mental Activities	20

Each examination is built as closely as possible to the above specifications. Small adjustments in the emphasis may be necessary because the examination includes multimark written-response questions and/or machine-scored questions that cover more than one concept area. The concept areas are distributed proportionately over the cognitive levels and vice versa. Questions that require knowledge and skill in applying scientific processes are distributed throughout the examination but are not associated with specific topics or cognitive levels.

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[1] Concept descriptions have been shortened in this table.

*This change in emphasis is outlined in the following pages.

[2] An explanation of cognitive levels is given in Appendix C.

Emphases in the 1992 Chemistry 30 Diploma Examinations

- **Written-response questions will be also evaluated on how well the answer is communicated.**
- Some questions will include concepts from more than one of the core concepts.
- Written-response questions will continue to include a written component that requires students to see relationships among concepts learned.
- Written-response questions may require students to write balanced chemical reaction equations including correct states of matter.
- Numerical answers are to be rounded only once, at the end of the question. Intermediate numbers are to be as displayed on the calculator.
- The diploma examination treats the terms oxidation number and oxidation state as synonyms. It has come to our attention that some resource materials are making an artificial and false distinction between these terms.

Changes to the 1992 Chemistry 30 Diploma Examination

Two changes will be made in the 1992 Chemistry 30 diploma examinations:

- The examinations will utilize the revised numerical-response format. A detailed discussion of this format is on pages 29 to 31.
- The multiple-choice section of the examination will be reduced by seven questions (10%) to accommodate an increase of seven marks (10%) in the written-response section. The written-response section of the examination will retain the three-question format. In general, the increase in marks will be applied primarily to assessment of the nature of communication in the response. A draft copy of the communications scoring guide is on page 21, and examples of how it will be applied are given on pages 22 to 28.

Changes to the Chemistry Field Testing Formats

This school year, several different field test formats will be available. If you are interested in field testing any of the following tests, please contact Field Testing Services at 427-0010.

Type	Format	Maximum Time
A	17 Multiple Choice 3 Numerical Response 3 Written Response	80 min
B	17 Multiple Choice 3 Numerical Response 1 Written Response	60 min
C**	Same as B except questions on equilibrium are included	60 min
D**	Two-part field test composed of the following:	120 min
	• 30 Multiple Choice • 5 Numerical Response	60 min
	• 5 or 6 Written Response	60 min
	(Limited number of these may be used individually.)	

**new format

Chemistry Data Booklet Update

Several minor revisions have been made to the data booklet and they are as follows:

- Ion product for water has been changed to 1.00×10^{-14} mol^2/L^2
- The spelling of element 101 in the periodic table is now correct.
- The oxidizing agent hydrogen peroxide has been removed from the standard electrode potential table.

The next revision may occur when the new Chemistry 30 curriculum is implemented.

Overview of the Communications Component of the Written Response

The intent of evaluating communications is to reward students for creating a response that is on topic, clear, concise, and well written. Communications assessment on the chemistry diploma examinations will focus on three main criteria.

First, the response must be on topic. However, the response does not have to be 100% correct. For example, a student who selects incorrect oxidizing and reducing agents in a redox question will not lose communication marks, because the error was in content appropriate to the question. If a student responds to a redox question as if it were an acid-base question, no communication marks will be given regardless of how well the response is written because the answer is off topic. Communication in the context of the chemistry diploma examination is loosely coupled to content, in that the response need not be correct but it must be appropriate.

Secondly, the response must stand alone and require no interpretation. This means that the reader does not have to read the question to understand the response, nor does the reader have to infer or interpret the response.

Thirdly, the response must respect the conventions of the mode of communication selected. For example, if a student elects to write a net ionic equation, the reactants and the products should have the appropriate states. If a student elects to respond in paragraph form, proper sentence structure (i.e., complete sentences) and correct spelling should be used.

To illustrate these criteria, a draft scoring guide and seven examples follow.

DRAFT SCORING GUIDE

COMMUNICATION SKILLS (V8.1)

Level	Criteria	Comments
4 (80% or better)	The reader does not have to interpret any part of the response. No reference to the question is needed to understand the response. The response is clear, concise, and presented in an logical manner. All conventions of the mode of communication are followed.	• at least 1/3 of the topic covered • there may be errors in content
3 (65% or better)	The reader does not have to interpret any part of the response. However, there are errors in the conventions of the mode of communication and/or the response is poorly organized.	• at least 1/3 of the topic covered • there may be errors in content
2 (50% or better)	The reader has to interpret the response or is required to seek information in the question in order to understand the response. The response may be ambiguous and/or disorganized. However, all the conventions of the mode of communication are followed.	• at least 1/3 of the topic covered • there may be errors in content
	OR The response is limited in length; however the completed portion meets the criteria of a 4.	• under 1/3 of the topic covered • there may be errors in content
1 (35% or better)	The reader has to interpret the response or is required to seek information in the question in order to understand the response. The response may be ambiguous and/or disorganized. There are errors in the conventions of the mode of communication.	• at least 1/3 of the topic covered • there may be errors in content
	OR The response is limited in length; however, the completed portion meets the criteria of a 3.	• at least 1/3 of the topic covered • there may be errors in content
0	No evidence of communication; the response may be only a number or word.	• insufficient work to access communication skills.
NR	No response given	

SAMPLES

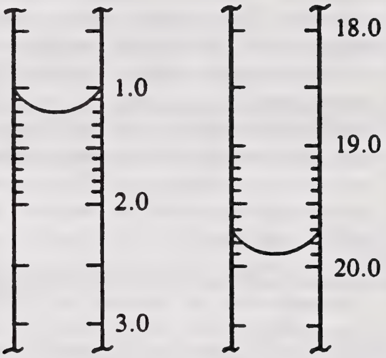
Use the following information to answer question 2.

The diagram shows the initial and final burette readings of the $NaOH_{(aq)}$ used to titrate 25.0 mL of 0.206 mol/L $HCl_{(aq)}$.

Vol. of NaOH

= 19.9 mL − 1.2 mL

= 18.2 mL



2. a. Write a balanced chemical equation for this reaction and calculate the concentration of $NaOH_{(aq)}$.

$HCl_{(aq)} + NaOH_{(aq)} \rightarrow H_2O_{(l)} + NaCl_{(aq)}$

mol of HCl = $0.206 \frac{mol}{L} \times 0.025 L = 0.00515$ mol

mol of NaOH = 0.00515 mol $\times \frac{1}{1} = 0.00515$ mol

Conc. of NaOH = $\frac{0.00515 \text{ mol}}{0.0182 \text{ L}} = 0.283 \text{ mol/L}$

Level 4

The response is clear, concise, and well organized. There is an error in content but there are no errors in communication. Although part "b" was not attempted, sufficient work is present for a level 4.

b. If air had been present in the tip of the burette at the beginning of the titration but was not present at the end, would the calculated experimental value for the $NaOH_{(aq)}$ concentration in part 2. a. be higher, the same, or lower than the actual value?

Why?

1. You are given a paraffin candle and are asked to determine the heat of combustion of paraffin in J/g. Outline briefly **in sentence form** the **step-by-step** experimental procedure you would follow, using the equipment listed below, to obtain the necessary data.

Equipment

glass beaker and water
electronic balance
matches

paraffin candle
thermometer(°C)
beaker tongs

Procedure:

① way candel
3 ~~②~~ way beeker & water together
2 ~~③~~ way empty beeker
④ set the candel under the beeker containing with water. Hold the beeker with tongs.
⑤ Lite candle
⑥ heat water for 10 min. and then put out the fire
⑦ take the highest temperture
⑧ way the candel again

Level 3

Despite errors in the conventions of the mode of communication, this response meets the criteria for Level 3 because it is clear and concise. As well, the reader does not have to do any interpreting or guessing. The response is complete, on topic, and the steps are chronological.

1. You are given a paraffin candle and are asked to determine the heat of combustion of paraffin in J/g. Outline briefly **in sentence form** the **step-by-step** experimental procedure you would follow, using the equipment listed below, to obtain the necessary data.

Equipment

glass beaker and water	paraffin candle
electronic balance	thermometer(°C)
matches	beaker tongs

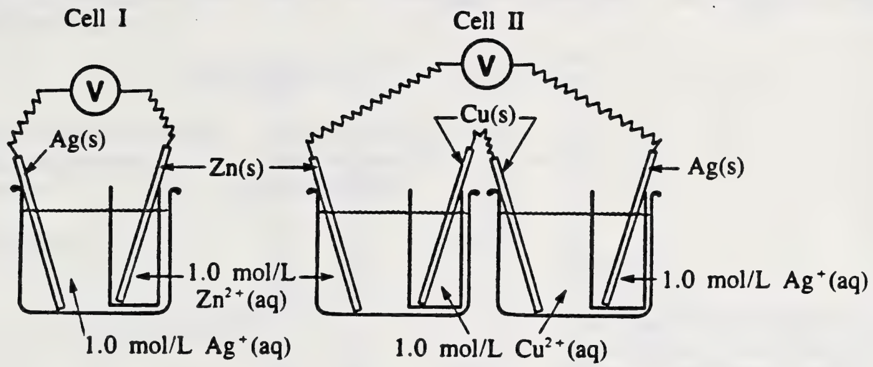
Procedure:

(1.) measure the beaker
(2.) put in some water and measure again
(3.) measure candle
(4.) burn candle under water for 10 minutes
(5.) take final temperature
(6.) measure the candle again

Level 2

This student is on topic and does a good job of responding using point form. However, even though the student probably understands the concept well, the student fails to communicate this to the reader. The reader must infer that by "measure" the student means "record the mass of," and that in step 4 the candle is not being burned under the water surface but under the beaker containing the water. Does the "final temperature" occur when the candle is extinguished or when the highest temperature is reached? These ambiguities result in a level 2 communication assessment being awarded.

Use the following information to answer question 3.



3. a. Why does cell I produce the same voltage as cell II?

b. What is the net $E°$ value for cell II?

$E°$ net for cell

$2(Ag^+(aq) + 1e^- \rightarrow Ag(s))$ $E° = 0.80\ V$

$Zn(s) \rightarrow Zn^{2+}(aq) + 2e^+$ $E° = 0.76\ V$

$2Ag^+(aq) + Zn(s) \rightarrow Zn^{2+}(aq) + 2Ag(s)$ $E° = 1.56\ V$

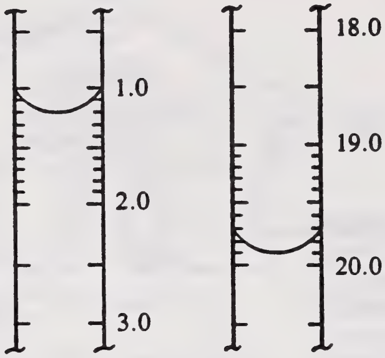
c. What is the purpose of the porous cup?

Level 2

The reader does not have to refer to the question or interpret the response. The response is appropriate to that part of the question. However, the response is insufficient to award full marks for the entire question. Because there are no errors in the mode of communication selected, a level of 2 is assigned.

Use the following information to answer question 2.

The diagram shows the initial and final burette readings of the $NaOH_{(aq)}$ used to titrate 25.0 mL of 0.206 mol/L $HCl_{(aq)}$.



2. a. Write a balanced chemical equation for this reaction and calculate the concentration of $NaOH_{(aq)}$.

$$\frac{(18.7)\ \cdot 206 \text{ mol/L}}{25}$$

0.1540 mol/L

Level 1

The reader has to interpret the response and refer to the question to understand the response. There are errors in the conventions of the mode of communication.

b. If air had been present in the tip of the burette at the beginning of the titration but was not present at the end, would the calculated experimental value for the $NaOH_{(aq)}$ concentration in part 2. a. be higher, the same, or lower than the actual value?

Why?

not enough added,
more was needed

1. You are given a paraffin candle and are asked to determine the heat of combustion of paraffin in J/g. Outline briefly **in sentence form** the **step-by-step** experimental procedure you would follow, using the equipment listed below, to obtain the necessary data.

Equipment

glass beaker and water
electronic balance
matches
paraffin candle
thermometer(°C)
beaker tongs

Procedure:

Use the balance to weigh the enitial and final mass of the candle

Use $\Delta H = mcDt$

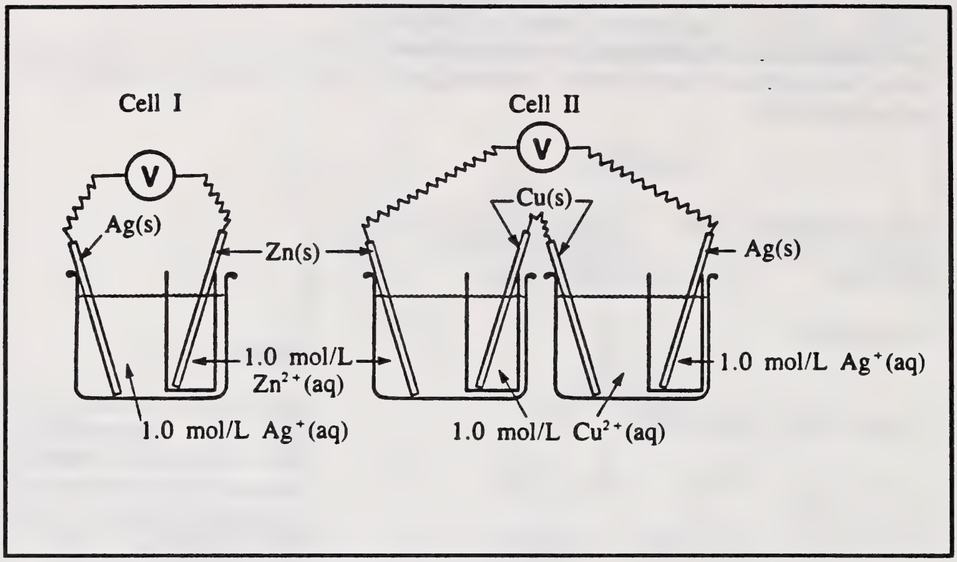
$$= \frac{mCDt}{n}$$

↖ but n here is grams of wax not moles, then solve.

Level 1

Only part of this response is on topic. The explanation of the calculation, though correct, is off topic because the question does not ask for this information. The response is appropriate to a Level 2. However, the errors in the conventions of the mode of communication result in this response being assigned a Level of 1.

Use the following information to answer question 3.



3. a. Why does cell I produce the same voltage as cell II?

b. What is the net $E°$ value for cell II?

c. What is the purpose of the porous cup?

allows ions move through the cell → maintain neutrality

Level 0

The length of the response is so limited, even though on topic, that it is difficult to assess communication skills. The answer requires the reader to refer to the question to understand the response.

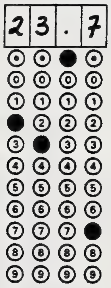
If the response had respected the conventions of sentence structure, it would have met the criteria for a Level 1 response.

Two changes will be made in the 1992 series of diploma examinations for chemistry, mathematics, and physics. The first change is that all three subjects will use similar instructions and format for numerical-response questions. The second change is in the answer sheet design. A new answer sheet will replace the chemistry, mathematics, and physics form. In the new form, a row has been added that contains the decimal, as shown in the examples.

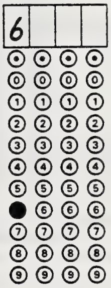
Students will now select the placement of and fill in a circle for the decimal. In all cases, students will begin writing the answer in the left field and leave any unused fields blank.

Examples:

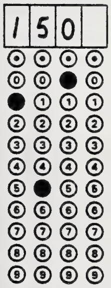
23.7



6



150



A sample of the instruction page and several question examples can be found on pages 30 and 31.

Instruction Sheet for Chemistry Numerical-Response Questions

PART B

INSTRUCTIONS

In this part of the examination, there are seven numerical-response questions each with a value of one mark. All numbers used in the questions are to be considered as the result of a measurement. Read each question carefully.

Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles. Enter the first digit of your answer in the left-hand box.

Use an HB pencil only.

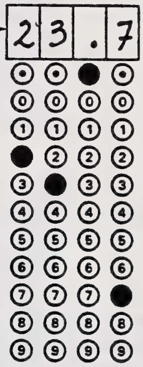
Sample Calculation Question and Solution

The mass in grams of silver produced when 0.220 mol silver nitrate reacts with excess copper is ________g. (Express your answer in three digits.)

$$\begin{aligned} \text{massAg} &= 0.220 \text{ mol} \times 107.87 \text{ g/mol} \\ &= 23.7314 \text{ g} \\ &= 23.7 \text{ g (rounded to three digits)} \end{aligned}$$

Record 23.7

Answer Sheet



Sample Correct-order Question and Solution

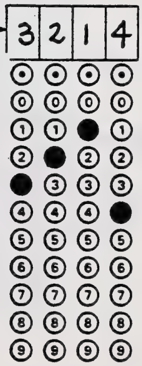
When the following subjects are arranged in alphabetical order, the order is ______________.

1. mathematics
2. chemistry
3. biology
4. physics

Answer 3, 2, 1, 4

Record 3214

Answer Sheet

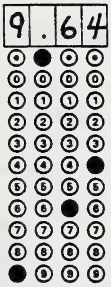


If you wish to change an answer, erase all traces of your first answer.

START PART B IMMEDIATELY

Sample Chemistry Numerical-Response Questions and New Answer Sheet

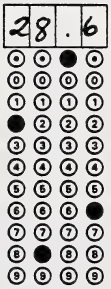
Calculation-based Examples



1. A 25.0 g ice cube at -15.0°C is placed into a foam cup containing orange juice. After the ice cube melts, the final temperature of the mixture is 5.00°C. The amount of energy absorbed during the above change is _________kJ. (Express your answer in three digits.)

   Unrounded value: 9.64304772

   Value to be recorded: 9.64



2. The volume, in millilitres, of 6.00 mol/L $H_2SO_{4(aq)}$ required to neutralize 13.71 g of $NaOH_{(s)}$ is __________mL. (Express your answer in three digits.)

   Unrounded value: 28.5625

   Value to be recorded: 28.6

Sequence-based Example

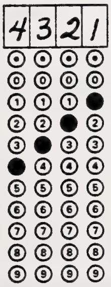
Use the following information to answer question 1.

1. $Br_{2(l)} + 2e^- \rightarrow 2Br^-_{(aq)}$
2. $Sn^{4+}_{(aq)} + 2e^- \rightarrow Sn^{2+}_{(aq)}$
3. $Ni^{2+}_{(aq)} + 2e^- \rightarrow Ni_{(s)}$
4. $Zn^{2+}_{(aq)} + 2e^- \rightarrow Zn_{(s)}$

1. When the half-reactions are arranged from highest oxidation potential to lowest oxidation potential, the order is _____________.

   Answer: 4, 3, 2, 1

   Value to be recorded: 4321



PHYSICS 30

Performance Standards

Students who attain a minimum *acceptable* standard of performance but do not attain the standard of excellence in Physics 30 have gained new skills and knowledge in physics but can anticipate severe difficulties if they choose to enrol in postsecondary physics courses. Such students can state and solve problems that can be related quickly to an equation in the data booklet. Their laboratory skills are limited to following explicit directions and to using laboratory data to verify known physics information. These students are capable of defining and calculating quantities such as slope, refractive index, orbit radius, electric force, and photoelectric work function. They tend to use item-specific methods in their problem solving and rarely use the major generalizations of physics such as Newton's Laws or the conservation laws of charge, momentum, and energy. These students rely heavily on the equations provided in the data booklet and often use such equations outside the equations' domain of validity.

Students who attain a standard of *excellence* in Physics 30 have demonstrated their ability and interest in both mathematics and physics and feel confident about their scientific abilities. These students should encounter little difficulty in postsecondary physics programs and should be encouraged to pursue careers in which they will utilize their talents in physics. Minor changes in problem format do not cause these students major difficulties. Exceptional students show far more flexibility and creativity than the average. They seek general methods and are not afraid to use conservation laws to solve an unusual problem. They transfer knowledge from one area of physics to another and can express their answers in clear and concise terms. In the laboratory, exceptional students can cope with data that are less than perfect or with instructions that are incomplete. They make inferences that are not part of the "known" parts of physics. In terms of concept development, they can make the distinction between vectors and scalars and between forces and fields. This group of students can also apply these distinctions to solve problems.

Structure of the Examination

Each Physics 30 diploma examination is designed to reflect the core concepts outlined in the *Program of Studies for Senior High Schools*. The examination is limited to those objectives that can be measured by a paper and pencil test.

Content

The 1992 Physics 30 diploma examinations have the approximate emphasis on core concepts.

Concepts[1]	Per Cent Emphasis
Nature and Behavior of Light	25
Electric and Magnetic Fields	25
Electromagnetic Radiation	15
Structure of Matter	20
Modern Physical Theories	15

---

[1] Concept descriptions have been shortened in this table.

Design

The design of the 1992 Physics 30 diploma examinations is as follows:

Question Format	Number of Questions	Per Cent Emphasis
Multiple Choice	42	60
Numerical Response	7	10
Written Response	4	30

Examination Specifications

The three cognitive levels[2] of Knowledge, Comprehension and Application, and Higher Mental Activities are addressed throughout the examination. The emphasis on each cognitive level for each section of the examination is as follows:

Multiple Choice and Numerical Response	Per Cent Emphasis
Knowledge	25
Comprehension and Application	35
Higher Mental Activities	10
Written Response	
Comprehension and Application, Higher Mental Activities	30

Each examination is built as closely as possible to the above specifications. Small adjustments in emphasis may be necessary because the examination includes multimark written-response questions and/or machine-scored questions that cover more than one concept area. The concept areas are distributed proportionately over the cognitive levels and vice versa. Questions that require knowledge and skill in applying scientific processes are distributed throughout the examination but are not associated with specific topics or cognitive levels.

Emphases in the 1992 Physics 30 Diploma Examinations

- Some questions will require the synthesis of concepts from more than one of the core concepts.

- In all written-response questions involving calculations, an explicit formula statement is required as a first step, with the substituted values explicitly written down in a subsequent step.

- Numerical answers are to be rounded only once, at the end of the question. Intermediate numbers are to be used as displayed on the calculator.

- Routine calculations based on the equations in the data booklet will be limited to 30% of the examination.

---

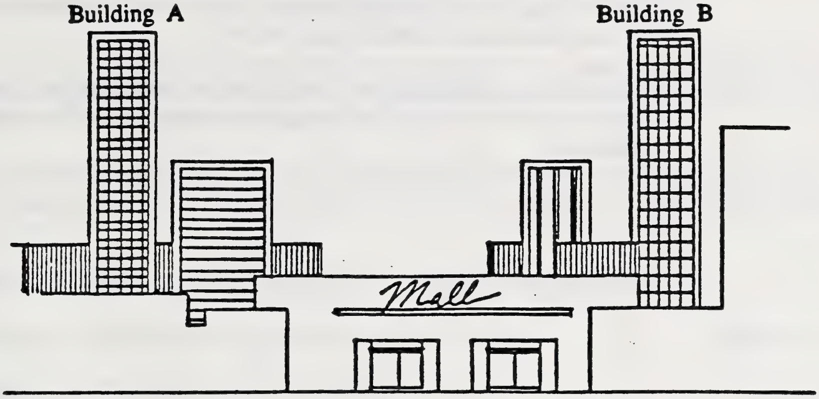
[2] An explanation of cognitive levels is given in Appendix C.

- The written-response section of the examination will contain one open-ended question worth approximately 10% of the examination. This question will involve an integration of various concepts covered in the Physics 30 course. On this question, students' communication skills will be evaluated. A suggested scheme for awarding the communication skills mark follows.

2 marks	Presentation of ideas or solutions is coherent and well organized. Complete sentences are used where descriptive answers are required. Writing communicates understanding of basic underlying concepts and relationships.
1 mark	Ideas or solutions are presented but not in a coherent and organized manner. The reader has difficulty following the solution but is able to presume that the student understands underlying concepts and relationships.
0 marks	The response is very disjointed. Ideas are not presented clearly or are missing. Direction is lacking and understanding of underlying concepts and relationships is not evident in solutions. The material presented does not communicate the intended task.

The following is a sample question in which communication skills can be assessed using the suggested scheme.

Use the following information to answer question 4.



Buildings A and B are each 25 stories tall. Between them are a large shopping mall and other smaller buildings. The distance between buildings A and B was measured, using a laser and other electronic instruments, three times per day. The measurements are given in the table:

Distance (m)	Time of day
15 165.67	7:00 a.m.
15 165.35	11:00 a.m.
15 165.12	3:00 p.m.
15 165.53	7:00 a.m.
15 165.22	11:00 a.m.
15 165.18	3:00 p.m.
15 165.58	7:00 a.m.
15 165.31	11:00 a.m.
15 165.20	3:00 p.m.

The laser and other electronic instruments operate on standard 115 V electrical outlets. The laser and auxiliary timing equipment can measure all distances greater than 10 metres to seven significant digits.

4. a. What is the average measured distance between buildings A and B?

b. Listed below are three hypotheses to account for variation in the measured distance between buildings A and B. Choose one of the hypotheses and discuss its validity. Your discussion must be based on concepts studied in high school Physics and should include an outline of how the chosen hypothesis may be tested.

i. The voltage applied to the laser changes with time, thus affecting the frequency emitted by the laser and, therefore, the measured distance.

ii. The refractive index of air depends on temperature.

iii. The buildings sway.

Changes to the 1992 Physics 30 Diploma Examinations

- The 1992 Physics 30 examinations will include a numerical-response section for the first time. These seven questions will involve routine calculations and will be classified as predominantly comprehension and understanding. The questions will be machine-scored and the number of digits required in the answer will be indicated.

- Similar instructions and format for the numerical-response section will be used for chemistry, mathematics, and physics. A sample instruction sheet is on page 37.

- A new answer sheet will replace the one used in 1991. In the new form, a row of decimal points has been added. The student is responsible for placing the decimal in answers that require it. In all cases, the student will begin writing the answer in the left field and leave any unused fields blank. Several examples of different types of numerical-response questions are on pages 38 and 39.

New Directions for the 1992 Field Tests

- Numerical-response questions will continue to be field tested. Each one-hour field test will contain 15 multiple-choice questions, five numerical-response questions, and one written-response question.

- Open-ended written-response questions covering experimental design and practical technology will also continue to be tested in the 1991-92 school year.

Instruction Sheet for Physics Numerical-Response Questions

PART B

INSTRUCTIONS

In this part of the examination, there are three numerical-response questions each with a value of one mark. All numbers used in the questions are to be considered as the result of a measurement. Read each question carefully.

Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles. Enter the first digit of your answer in the left-hand box.

Use an HB pencil only.

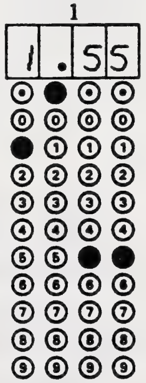
Sample Calculations Question and Solution **Answer Sheet**

1. If the angle of incidence in air is 47.3° and the angle of refraction is 28.3°, the index of refraction is ___________.
(Express your answer in three digits.)

$$n = \frac{\sin \theta_1}{\sin \theta_2}$$

$$n = \frac{\sin 47.3°}{\sin 28.3°} = 1.550164$$

Record 1.55



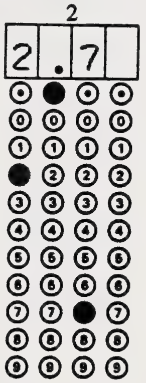
2. A microwave of wavelength 11 cm has a frequency of $b \times 10^9$ Hz. The value of b is ___________.
(Express your answer in two digits.)

$$f = c/\lambda$$

$$= \frac{(3.00 \times 10^8 \text{ m/s})}{(0.11 \text{ m})}$$

$$f = 2.727... \times 10^9 \text{ Hz}$$

Record 2.7



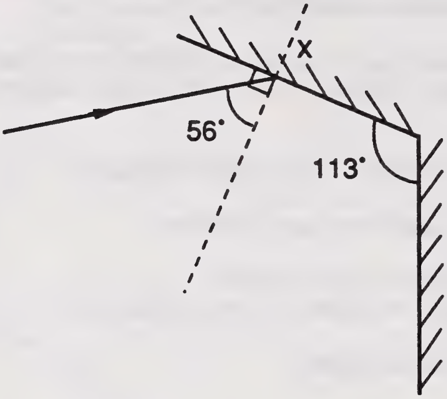
The answers 2.70, 2.72, and 2.73 will all be marked as incorrect, as the answer is required to have two digits only.

If you wish to change an answer, erase ALL traces of your first answer.

START PART B IMMEDIATELY.

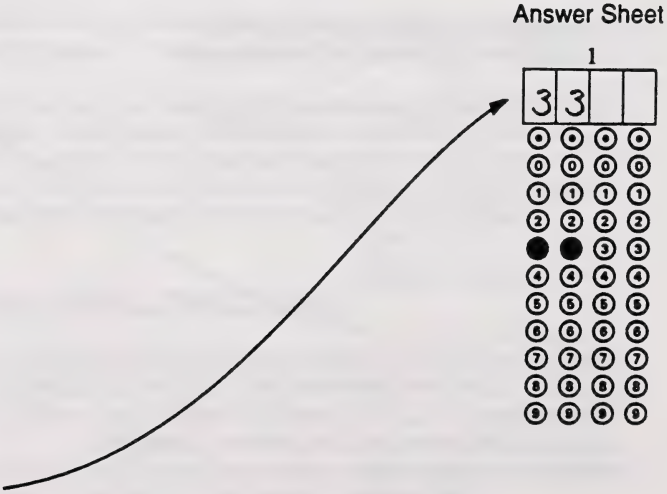
Sample Numerical-Response Questions

Use the following information to answer question 1.



A ray of light hits the first mirror at point X and is reflected to the second mirror, where it is reflected again.

1. If the angle of incidence is 56° and the angle between the mirrors is 113°, then the angle between the final reflected ray and the second mirror is ___________. (Express your answer in two digits.)

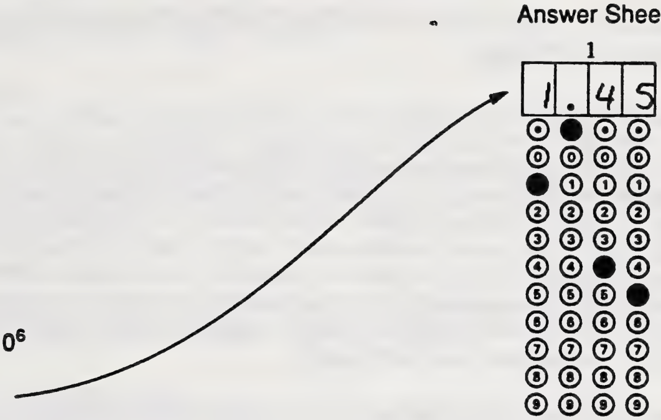


Answer: 33

Recorded Answer: 33

RECORD THE ANSWER ON THE ANSWER SHEET

2. If a proton is accelerated from rest through a potential difference of 1.10×10^6 V, it attains a final speed, expressed in scientific notation, of $b \times 10^w$ m/s. The value of *b* is _________. (Express your answer in three digits.)

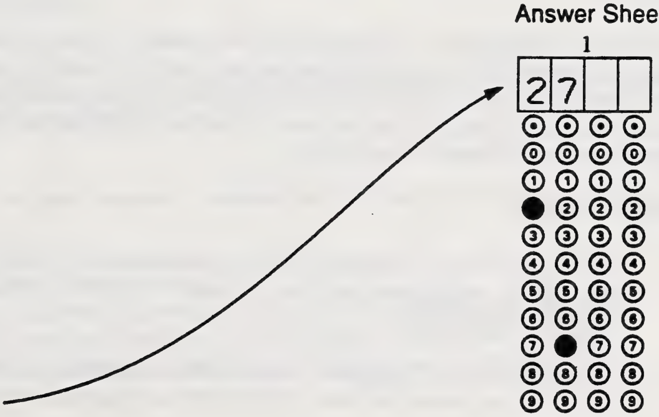


Answer: 1.451821×10^6

Recorded Answer: 1.45

RECORD THE ANSWER ON THE ANSWER SHEET

3. The momentum of a photon with 5.1×10^{-19} J of energy, expressed in scientific notation, is $b \times 10^{-w}$ kg•m/s. The value of the exponent *w* is __________.



Answer: 1.7×10^{-27}

Recorded Answer: 27

RECORD THE ANSWER ON THE ANSWER SHEET

APPENDIX A

POLICY: USE OF CALCULATORS ON ALBERTA EDUCATION DIPLOMA EXAMINATIONS

BACKGROUND

In 1981, Alberta Education produced *Guidelines for the Use of Calculators Grades 1-12* encouraging the use of calculators from Grade 1 through Grade 12. The Minister's task force on computers in schools added reinforcement to this position in their 1983 report, *Computers in Schools*. The report recommended that by 1985, all students in Alberta schools should have regular access to computer learning stations. The *Guide to Education, Senior High Handbook, 1991-92*, outlines expectations that students are to use selected technologies. Senior high school mathematics programs include specific learner expectations requiring hands-on use of graphing calculators and computers.

The 1981 document provided basic guidelines and principles for using calculators on Alberta Education examinations. Student Evaluation Branch updated these directions with the formal *Calculator Policy* released in August 1988.

DEFINITION

This policy will consider a *calculator* to be a hand-held device designed primarily for mathematical computations. Included in this definition are those calculators having graphing capabilities, built-in formulas, mathematical functions, or other programmable features.

POLICY

To ensure compatibility with provincial *Programs of Study* and equity and fairness for all students, Alberta Education encourages the use of calculators, as defined above, by students when they are writing diploma examinations in mathematics and science. Examinations will be constructed to ensure that the use of particular calculators causes neither advantages nor disadvantages to individual students.

PROCEDURES

1. At the beginning of a course, teachers must advise students of Alberta Education's definition of calculators that may be used when they are writing mathematics and science diploma examinations.

2. In preparation for calculator failure when writing mathematics or science diploma examinations, students may bring extra calculators and batteries.

3. Supervising teachers must ensure that:
    a. all calculators used when writing diploma examinations fall within the definition provided with this policy;
    b. all calculators operate in silent mode;
    c. students do not share calculators when writing diploma examinations;
    d. when writing diploma examinations, students do not bring external devices to support calculators into the examination room. Such devices include:
        manuals, printed or electronic cards, printers, memory expansion chips or cards, external keyboards, or any annotations outlining operational procedures for calculators.

APPENDIX B

EXAMINATION RULES, GRADE 12 DIPLOMA EXAMINATIONS

ALL STUDENTS MUST COMPLY WITH THESE RULES

1. Student Identification
   Personal identification that includes a signature and a photograph will be requested. One of the following documents is acceptable: driver's licence, passport, or students' union card. Students must not write or attempt to write an examination under a false or fictitious identity, or knowingly provide false information on an application form.

2. Time
   Examinations must be written during the specified times. Students may not hand in a paper until at least one hour of the examination time has elapsed.

3. Entrance to the Examination Room
   Students must not enter or leave the examination room without the consent of the supervising teacher. Students who arrive more than one hour after an examination has started will not be allowed to write the examination. Students who arrive late but within the first hour of an examination sitting may be allowed to write only at the discretion of the supervising teacher.

4. Material Exchanges
   Neither copying nor exchanging of material between students is allowed. Notes in any form - including those on papers, in books, or stored in electronic devices - may not be brought into the examination room. Students must not talk, whisper, or exchange signs with one another.

5. Discussion
   Students must not discuss the examination with the supervising teacher unless the examination is incomplete or illegible.

6. Answer Sheets
   Only an HB pencil is to be used to record answers on the machine-scorable answer sheets.

7. Written-Response Sections
   All work for the written-response sections of the diploma examinations must be done in the examination booklet. Students are requested to write their revised work in blue or black ink for English 30, English 33, Francais 30, Social Studies 30, and Biology 30.

8. Identification on Examinations.
   Only the identification requested is to be entered on the examination booklet. Do not write your name or the name of your school anywhere in or on the booklet other than those places requested.

9. Materials Allowed

English 30, English 33: a dictionary and a thesaurus may be used for Part A only. Electronic devices are not allowed for either part.
Francais 30: a dictionary, a thesaurus, and a book of verb forms may be used for Part A only. Electronic devices are not allowed for either part.
Social Studies 30, Biology 30: Electronic devices are not allowed.
Mathematics 30: a tear-out data sheet is provided in the examination booklet. Calculators may be used but must not be shared by students.
Chemistry 30, Physics 30: a separate data booklet is provided for each of these examinations. Calculators may be used but must not be shared by students.

Students must provide their own writing materials including pens and HB pencils, calculators, or other necessary instruments. Tear-out pages for rough work are provided in each biology, chemistry, mathematics, and physics examination booklet.

10. Translation Dictionaries

No translation dictionaries are permitted in any subject. Exchange students must satisfy the same requirements as other students.

APPENDIX C

EXPLANATION OF COGNITIVE LEVELS

Knowledge

Knowledge is defined as those behaviors and test situations that emphasize the remembrance, either by recognition or recall, of ideas, material, or phenomena. This level comprises knowledge of terminology, specific facts (dates, events, persons, etc.), conventions, classifications and categories, methods of inquiry, principles and generalizations, and theories and structures.

Comprehension and Application

Comprehension refers to responses that demonstrate understanding of the literal message contained in a communication. This means that the student is able to translate, interpret, or extrapolate. Translation refers to the ability to put a communication into another language. Interpretation involves the reordering of ideas (inferences, generalizations, or summaries). Extrapolation is the ability to estimate or predict based on an understanding of trends or tendencies.

Application requires the student to apply an appropriate abstraction (theory, principle, idea, method) to a new situation.

Higher Mental Activities

Analysis, *synthesis*, and *evaluation* are included in the category of higher mental activities. Analysis comprises the ability to recognize unstated assumptions, to distinguish facts from hypotheses, to distinguish a conclusion from statements that support it, to recognize facts or assumptions that are essential to a main thesis or to the argument in support of that thesis, to distinguish cause-effect relationships from other sequential relationships, and to recognize a writer's viewpoint.

Synthesis is the production of a unique communication. It is the ability to propose ways of testing hypotheses, the ability to design an experiment, the ability to formulate and modify hypotheses, and the ability to make generalizations.

Evaluation is defined as making judgments about the value of ideas, solutions, and methods. It involves the use of criteria to appraise the extent to which details are accurate, effective, economical, or satisfying. Evaluation includes the ability to apply given criteria to judgments of work done, to indicate logical fallacies in arguments, and to compare major theories and generalizations.

APPENDIX D

GUIDELINES FOR SIGNIFICANT DIGITS, MANIPULATION OF DATA, AND ROUNDING IN THE MATHEMATICS AND SCIENCES DIPLOMA EXAMINATIONS

Significant Digits

1. Regardless of decimal position, for all nonlogarithmic values any of the digits 1 to 9 is a significant digit; 0 may be significant.

   e.g., 123 0.123 0.00230 2.30×10^3 all have 3 significant digits

2. Leading zeros are not significant.

   e.g., 0.12 and 0.012 have two significant digits

3. Trailing zeros to the right of the decimal are significant.

   e.g., 0.123 00 and 20.000 have five significant digits

4. Zeros to the right of a whole number are considered to be ambiguous. **The Student Evaluation Branch considers all trailing zeros to be significant.**

   e.g., 200 has three significant digits

5. For logarithmic values, such as pH, any digit to the left of the decimal is **not** significant.

   e.g., a pH of 1.23 has two significant digits, but a pH of 7 has no significant digits

Manipulation of Data

1. When adding or subtracting measured quantities, the calculated answer should be rounded to the same degree of precision as that of the least precise number used in the computation **if this is the only operation.**

   e.g., 12.3 (least precise)
   0.12
   12.34
   24.76

   The answer should be rounded to 24.8.

2. When multiplying or dividing measured quantities, the calculated answer should be rounded to the same number of significant digits as are contained in the quantity with the fewest number of significant digits **if this is the only operation.**

   e.g., (1.23)(54.321) - 66.81483

   The answer should be rounded to 66.8.

3. When a series of calculations are performed, the answer should not be rounded off based upon interim values.

   e.g., $(1.23)(4.321)/(3.45 - 3.21) = 22.145125$

   The answer should be rounded to 22.1

Rounding

1. When the first digit to be dropped is less than or equal to 4, the last digit retained should not be changed.

   e.g., 1.2345 rounded to three digits is 1.23

2. When the first digit to be dropped is greater than or equal to 5, the last digit retained should be increased by one.

   e.g., 12.25 rounded to three digits is 12.3

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